

Appl. No. 10/789,735
Amdt, dated October 3, 2005
Amendment under 37 CFR 1.116 Expedited Procedure
Examining Group 2676

PATENT

REMARKS/ARGUMENTS

Claims 1-9, 11-21, and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Larson et al. (US Patent No. 5,793,386) in view of Wichman et al. (US Patent Publication No. 2004/0227763). Claims 10 and 22-27 are allowed by the Examiner.

Claim Rejections - 35 U.S.C. § 103(a)

Applicants thank the Examiner for allowing Claims 10 and 22-27 as previously amended. Applicants respectfully submit that a prima facie case of obviousness has not been made as to Claims 1-9, 11-21, and 28 as the references cited do not contain all of the limitations of the present invention. This position is articulated below.

Claim 1

Claim 1 is presently rejected as being unpatentable over Larson et al. (hereinafter "Larson") in view of Wichman et al. (hereinafter "Wichman"). Claim 1 recites a method of texturing a pixel comprising steps of "storing a texture argument in a general purpose register of a register file" and "issuing a texture command to a texture request buffer, wherein the texture command is associated with the texture argument." Additional steps of "retrieving the texture command from the texture request buffer" and "retrieving the texture argument from the general purpose register" are also recited and further clarify the idea that separate data elements (texture command and texture argument) are identified with separate locations (texture request buffer and register file). This separation is important in the discussion which follows.

Modern graphics processing units often must handle a large number of texture requests, which can consume excessive amounts of hardware resources. For example, as described in paragraphs 6 and 7 of the specification, each texture request may require the storage of both a texture command and a related texture argument. With conventional techniques, this leads to the use of large FIFOs which may be expensive to manufacture and inefficient to use.

Applicants have solved this problem by issuing the texture command to a separate texture request buffer and storing the texture argument in a separate general purpose register file. Separating the texture argument from the texture command permits the graphics processing

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system to make more efficient use of its finite hardware resources. For example, in one embodiment, storing the texture arguments is essentially free. See, specification at paragraphs 25-27. That is, because the texture argument is stored apart from the texture command, there is no need to allocate resources to preserve the texture argument once the final texture value has been determined. Instead, efficiency may be achieved by overwriting the texture argument with the final texture value.

In addition, separating the texture command and the texture argument reduces the width of internal registers and may reduce manufacturing costs. This follows from the fact that texture arguments are typically much larger than texture commands. Thus, storing the texture command and its related texture argument together requires a register file with larger dimensions which may be more expensive to manufacture. This problem may become increasingly pronounced as the method is scaled to multiple execution units. The approach taken by the current invention of separating the texture command from its related texture argument and directing them to separate locations addresses this problem and may tend to reduce costs and promote the efficient use of resources.

Larson discloses a conventional technique by which texture commands and texture arguments are stored together. Specifically, Larson teaches a rendering method in which an instruction and a display list are first loaded together into a transaction queue. See *Larson*, col. 5, lines 25-29 ("Generally, the prefetch unit 110 fetches instructions and the display list and loads this information into the transaction queue 115 while the polygon and texture engines 135 are drawing previously fetched instructions."). Subsequently, the instruction and display list are transferred together to a register file for further processing. See *Larson*, col. 5, lines 44-47 ("Under direction of the prefetch unit 110 and execution unit 125, the contents of the transaction queue 115 are transferred to a register file 150 for subsequent rendering by the polygon and texture engines 135."). Clearly, the instruction (which the examiner cites as the "texture command") and the display list (which the examiner cites as the "texture argument") are stored together in the transaction queue. Also, the instruction and the display list are stored together in the register file. Thus, Larson fails to disclose "storing a texture argument in a general purpose

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register of a register file" and "issuing a texture command to a texture request buffer, wherein the texture command is associated with the texture argument." Nor does Larson teach or suggest "retrieving the texture command from the texture request buffer" and "retrieving the texture argument from the general purpose register."

Wichman does not cure these deficiencies. Wichman discloses a traditional instruction code format that specifies source and destination operands. *See e.g., Wichman*, Figures 4A-4C and 5A-5C. However, these operands do not teach or suggest "storing a texture argument in a general purpose register of a register file" and "issuing a texture command to a texture request buffer, wherein the texture command is associated with the texture argument." Nor do the operands teach or suggest "retrieving the texture command from the texture request buffer" and "retrieving the texture argument from the general purpose register." Therefore, even if combined, the teachings contained in these references do not disclose all of the limitations of the claimed invention.

Finally, it should be noted that the texture command and texture argument are not interchangeable. The present invention clearly calls for "storing a texture argument in a general purpose register of a register file" and "retrieving the texture argument from the general purpose register." Also, the claimed invention provides for "issuing a texture command to a texture request buffer" and "retrieving the texture command from the texture request buffer."

Notwithstanding the Examiner's remarks in paragraph 4 of the most recent Office Action, the texture request buffer and register file each performs a different function involving different types of data that is used in different ways by the graphics processing system. These differences cannot be disregarded.

Applicants respectfully submit that a prima facie case of obviousness has not been made and, accordingly, request withdrawal of the rejection of claim 1. Specifically, Larson does not disclose "storing a texture argument in a general purpose register of a register file" and "issuing a texture command to a texture request buffer, wherein the texture command is associated with the texture argument." To the contrary, Larson teaches away from the present invention by calling for the instruction and display list to remain together. Larson in view of

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Wichman does not cure these deficiencies as this combination does not disclose all of the limitations of claim 1. Thus, applicants respectfully request reconsideration and allowance of claim 1.

Claim 13

The Examiner states that claim 13 is similar in scope to claims 1-9 and claim 11 and that claim 13 is therefore rejected under the same rationale. For at least the reasons discussed above with respect to claim 1, claim 13 is also patentable over Larson in view of Wichman. Thus, applicants respectfully request reconsideration and allowance of claim 13.

Claim 28

Claim 28 recites "an execution unit comprising a texture request buffer and a register file, the register file including a plurality of general purpose registers, wherein the execution unit is adapted to issue a texture command to the texture request buffer and to store a texture argument in the register file" and "a texture unit adapted to read the texture command from the texture request buffer and to retrieve the texture argument from the register file" among other elements. For at least the reasons discussed above with respect to claim 1, claim 28 is also patentable over Larson in view of Wichman.

Claims 2-9, 11 and 12

Claims 2-9, 11, and 12 depend from claim 1 and therefore each includes the limitations of claim 1. For at least the reasons discussed above with respect to claim 1, claims 2-9, 11, and 12 are also patentable over Larson in view of Wichman.

Claims 14-21

Claims 14-21 depend from claim 13 and therefore each includes the limitations of claim 13. For at least the reasons discussed above with respect to claim 13, claims 14-21 are also patentable over Larson in view of Wichman.

CONCLUSION


In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance and an action to that end is respectfully requested.

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If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,


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